
5 PREVENTATIVE MAINTENANCE

Preventative maintenance is a critical maintenance activity that may be used in order to delay or reduce the need for repair maintenance, as well as increasing the useful life of field devices. Based on the stakeholder meetings described in Chapter 2, however, preventative maintenance is generally underperformed or neglected by ODOT because of inadequate knowledge of the frequency and nature of required preventative maintenance tasks as well as inadequate staffing levels. This chapter will focus on the first of these causes by delineating appropriate preventative maintenance tasks for each device in ODOT's existing and planned ITS infrastructure. This will be followed by a brief discussion of roles and responsibilities relating to preventative maintenance, and recommendations for actions with respect to pursuing preventative maintenance more consistently.

5.1 Recommended Practices

Because preventative maintenance is sometimes considered to be a “luxury” when resources are constrained, there is often not a consensus on what the best preventative maintenance practices for each device should be. Table 5-1 shows a summary of recommended preventative maintenance tasks and frequencies for the various elements of ODOT's existing and planned ITS infrastructure. Recommended frequencies are based on a review of guidelines developed by Caltrans and the Washington State Department of Transportation (WSDOT) in conjunction with the ITS maintenance plans they developed (6, 7), as well as conversations with product vendors and ODOT personnel.

5.2 Roles and Responsibilities

Because of the time-insensitive nature of many preventative maintenance activities, they could be performed in a “vacuum” – i.e. independent of the two-tier maintenance model presented in Chapter 3. For example, electricians may develop a regular rotation schedule to address preventative maintenance needs in a particular region without the explicit knowledge of the support coordinator. While this approach helps to shift some coordination work away from the support coordinator, it has the drawback of discouraging economy in trips to field devices. For example, if a repair visit occurs a couple of days before a scheduled preventative maintenance activity, the technician could do both the repair and preventative maintenance in one trip, providing savings in travel time. Therefore, preventative maintenance activities should be coordinated through the support coordinator, similar to repair maintenance activities.

5.3 Recommendations

In order to implement an effective preventative maintenance schedule, the following actions are recommended.

- Document required preventative maintenance tasks for each device. A detailed checklist should be developed for field personnel that would list all tasks that are to be performed on each preventative maintenance visit. This checklist would help to guide training of new maintenance personnel, as well as provide a way of ensuring

Device	Component	Maintenance Procedure	Frequency
Data Collection			
Automatic Traffic Recorders (1)	Controller	Check batteries; visual inspection and cleaning; check connections	Every 12 months
	Loops	Visual inspection and testing	Every 12 months
	Cabinet	Visual inspection and cleaning	Every 12 months
Speed Zone Monitoring Stations (1)	Controller	Check batteries; visual inspection and cleaning; check connections	Every 12 months
	Loops	Visual inspection and testing	Every 12 months
	Cabinet	Visual inspection and cleaning	Every 12 months
Closed-Circuit TV (CCTV) Surveillance	Support Structure	Visual inspection	Every 12 months
	Pan-Tilt-Zoom Units	Visual inspection and testing	Every 6 months
	Camera / Lens / Filter	Clean lens; visual inspection; check enclosure pressure	Every 6 months
	Camera Housing / Cables	Cleaning and visual inspection; check connections	Every 6 months
	Camera Control Receiver	Check pan-tilt-zoom capability using laptop; check connections	Every 6 months
	Camera Servers and Modems	Visual inspection and check connections	Every 12 months
	Weather Equipment	Visual inspection and calibration	Every 12 months
	Surge Protection / Power	Visual inspection and testing	Every 6 months
	Video switching equipment (Region 1)	Visual inspection and testing; check connections	Every 6 months
	Video rack equipment (Region 4)	Visual inspection and testing; check connections	Every 6 months
Camera Server Software	Install manufacturer upgrade	As available	
Camera Server	Database and server management activities	Every week	
Video Detectors	Support Structure	Visual inspection	Every 12 months
	Video Detector	Clean lens; visual inspection; calibration	Every 12 months
	Controller	Check batteries; visual inspection and cleaning; check connections	Every 12 months
	Surge Protection / Power	Visual inspection and testing	Every 12 months
Road and Weather Information System (RWIS)	Sensors	Visual inspection; cleaning and calibration	Every 12 months
	Local cable and wiring	Visual inspection	Every 12 months
	RPU	Re-boot and visual inspection	Every 2 months
	Modems / Routers	Visual inspection; check connections	Every 12 months
	Software (SCAN & Database)	Install upgrades as available	As available
	Surge Protection / Power	Visual inspection and testing	Every 6 months
	Servers (Regional / Statewide)	Database and server management activities	Every week

(see last page of table for legend)

Table 5-1: Preventative Maintenance Schedule.

Device	Component	Maintenance Procedure	Frequency
Data Collection (cont.)			
Travel Time Estimation	Camera	Visual inspection; clean lens; test alignment	Every 6 months
	Light Source	Visual inspection and testing	Every 6 months
	Modems	Visual inspection; check connections	Every 12 months
	Controller / RPU	Re-boot and visual inspection	Every 2 months
	Software (RPU)	Install upgrades	As available
	Cabinet	Visual inspection and cleaning	Every 12 months
	Travel Time Server	Database and server management activities	Every week
	Software (Server)	Install upgrades	As available
Automatic Vehicle Location (AVL)	Vehicle sensors	Inspection, calibration and cleaning	Every 12 months
	AVL Software	Install upgrades	As available
	AVL Server	Database and server management activities	Every week
Traffic Management			
Ramp Metering (1)	Loops and Detectors	Visual inspection and testing	Every 3 months
	Signal Heads	Check bulbs and alignment	Every 3 months
	Signal Controller	Visual inspection; cleaning and testing	Every 3 months
	Controller cabinet	Visual inspection and cleaning	Every 3 months
Signal Preemption for Emergency Vehicles (1)	In-vehicle unit	Testing	Every 12 months
	Optical reader	Visual inspection and testing	Every 12 months
	Controller	Visual inspection and cleaning	Every 12 months
Preferential Signal Treatment for Transit (1)	In-vehicle unit	Testing	Every 12 months
	Optical reader	Visual inspection and testing	Every 12 months
	Controller	Visual inspection and cleaning	Every 12 months
Advanced Traffic Management System (ATMS)	Operator workstations	Re-booting, testing and upgrades	Every month
	Communications within TOC	Visual inspection; check connections and cabling	Every 12 months
	Software	Upgrades and enhancements	As available
	ATMS Database	Database pruning and management	Every week
	Servers	Server management activities	Every week
Incident Detection			
Callboxes	Telephone handsets	Test equipment	Every month
Cellular Call-in	Roadside signs (1)	Prune vegetation	Every 12 months
Regional Incident Detection System	Server	Database and server management activities	Every week
	Software	Install upgrades	As available
Intersection-Based Incident Detection System	Controller / RPU	Re-boot; visual inspection	Every 2 months
	Software / firmware	Install upgrades	As available

(see last page of table for legend)

Table 5-1: Preventative Maintenance Schedule. (cont.)

Device	Component	Maintenance Procedure	Frequency
Incident Management and Response			
Computer-Aided Dispatch (CAD)	CAD Server	Various computer maintenance activities	(2)
	CAD workstations	Re-booting, testing and upgrades	Every month
	Communications within TOC	Inspect, check connections and cabling	Every 12 months
	Software	Install upgrades	As available
	Database management	Various database management activities	(2)
Incident Response Vehicles	On-board VMS	Visual inspection and cleaning; testing	Every 6 months
	Vehicle maintenance	Based on mileage, manufacturer's recommendations	(1)
Pre-planned Detour Routes	Route selection	Test route selection algorithms in each region	Every 12 months
Hazardous Material Response	Modems / routers	Visual inspection, check connections	Every 12 months
	Software (database)	Install upgrades	As available
	HazMat Server	Server and database management activities	Every week
Pre-Trip Traveler Information			
Alphanumeric Paging	Software	Install upgrades	As available
Highway Travel Conditions Reporting System (HTCRS)	Database management	Pruning and database management	Every week
800-number Information	Communications in WRDC	Inspect, check connections and cabling	Every 12 months
	Software (voice generation)	Install upgrades	As available
	Software (phone server)	Upgrades and enhancements	As available
	Servers	Re-boot; server management activities	Every week
Internet Access	Web server	Re-boot; server management activities	Every week
Kiosks	Terminals	Inspect; clean monitors and cabinets	Every month
	Network connections	Check connections, replace cabling	Every 12 months
	Thermal printers	Check print quality; replace paper	Every month
	Software (Kiosk-level)	Install upgrades	As available
	Software (Server-level)	Install upgrades	As available
En-Route Traveler Information			
Changeable Message Signs (CMS) (1)	Controller / motor	Visual inspection and testing	Every 12 months
	Sign Display	Testing, cleaning; check illumination	Every 12 months
	Sign Housing	Visual inspection and check communications	Every 12 months
	Communications	Check modems and hardwire connections; check radio-activated connections	Every 12 months
	Surge Protection / Power	Visual inspection and testing	Every 12 months

(see last page of table for legend)

Table 5-1: Preventative Maintenance Schedule. (cont.)

Device	Component	Maintenance Procedure	Frequency
En-Route Traveler Information (cont.)			
Permanent Variable Message Signs	Controller / Internal Wiring	Visual inspection and testing	Every 6 months
	Sign Matrix, Panels, Modules	Testing and cleaning; replace bulbs and pixels as necessary	Every 6 months
	Display	Cleaning and visual inspection	Every 6 months
	Sign Housing	Visual inspection and check connections; clean filters	Every 6 months
	Modem / Communications	Visual inspection; check connections; test messages	Every 12 months
	Software	Install upgrades	As available
Portable Variable Message Signs	Controller / Internal Wiring	Visual inspection and testing	Every 3 months
	Sign Matrix, Panels, Modules	Testing and cleaning; replace bulbs and pixels as necessary	Every 3 months
	Display	Test messages	Every week
	Sign Housing	Visual inspection and check connections; clean filters	Every 3 months
	Software	Install upgrades	As available
	Power	Visual inspection and testing; check and replace batteries as necessary	Every 3 months
Highway Advisory Radio (HAR) (3)	Antenna Assembly	Visual inspection	Every 12 months
	Transmitter	Check power and range and frequency	Every 12 months
	Beacon equipment	Visual inspection and testing	Every 12 months
	Recorder / player unit	Testing; check connections	Every 12 months
	Operator workstation	Basic computer maintenance; test messages	Every 12 months
	Power supply	Check power level and connections	Every 12 months
Icy Bridge Detectors and Oversize Load Detectors	Sensors	Visual inspection; cleaning and calibration	Every 12 months
	Flashing beacon and sign	Visual inspection and testing	Every 12 months
	Field controller (4)	Visual inspection and testing	Every 2 months
	Controller cabinet	Visual inspection and cleaning	Every 12 months
	Software	Install upgrades	As available
	Communications equipment	Visual inspection; check connections	Every 12 months
Variable Speed Limit Signs (VSLs)	Sensors	Visual inspection; cleaning and calibration	Every 12 months
	Flashing beacon and sign	Visual inspection and testing	Every 12 months
	Field controller	Visual inspection and testing	Every 2 months
	Controller cabinet	Visual inspection and cleaning	Every 12 months
	Software	Install upgrades	As available
	Communications equipment	Visual inspection; check connections	Every 12 months

(see last page of table for legend)

Table 5-1: Preventative Maintenance Schedule. (cont.)

Device	Component	Maintenance Procedure	Frequency
En-Route Traveler Information (cont.)			
Queue Detection System	Controller / Timer	Check batteries, test induction, check connections	Every 12 months
	Loops	Visual inspection and testing	Every 12 months
	Flashing beacon / sign	Visual inspection and testing	Every 12 months
	Cabinet	Visual inspection and cleaning	Every 12 months
Commercial Vehicle Operations			
Weigh-in-Motion (WIM) Stations (5)	Sensors (axle, AVC, AVL, loops)	Test signal level and lead cable; calibrate	Every 6 months
	Single load cell scales	Test signal level and lead cable; calibrate	Every 6 months
	Piezoelectric sensors	Test signal level and lead cable; calibrate	Every 6 months
	Grout and sealant	Visual inspection	Every 6 months
	Detector housings and cabinets	Visual inspection; test ventilation	Every 6 months
	WIM electronics, power supplies and modems	Visual inspection; cleaning; testing	Every 6 months
	Modems / routers	Visual inspection; check connections	Every 12 months
	Cables and connectors	Visual inspection and testing	Every 12 months
	Red light / green light	Visual inspection and testing	Every 12 months
Downhill Speed Advisory System	WIM equipment (5)	See guidelines under Weigh-in-Motion systems	
	VMS equipment	See guidelines under Permanent Variable Message Signs	
Communications Systems			
Fiber Optics Networks	Landline cable	Perform optical time domain reflectometer tests	Every 24 months
Radio Communications	Hand-held units	Visual inspection; testing	Every 12 months
	Radio consoles	Visual inspection; testing	Every 12 months
	In-vehicle communications	Visual inspection; testing	Every 12 months
Maintenance Coordination			
Maintenance Coordination	Laptop computers	Visual inspection; re-boot and diagnostics	Every month
	Tracking software	Install upgrades	As available

Notes

- (1) Maintenance procedures are already in place.
- (2) Maintenance responsibility is outside of ODOT responsibility.
- (3) More frequent maintenance would be recommended for year-round operations.
- (4) Ice bridge warning system field controllers would need maintenance for only six months out of the year.
- (5) WIM maintenance responsibility is currently provided by vendors.

Table 5-1: Preventative Maintenance Schedule. (cont.)

that no tasks as neglected. The checklist could be based on Table 5-1, but would likely need to have greater detail to be of value to field personnel.

- Establish point-of-contact for coordinating and tracking preventative maintenance activities. The support coordinator role would be ideal for this, although record-keeping of preventative maintenance activities in some regions may become time-consuming enough that it should be delegated to individuals performing preventative maintenance.
- Incorporate preventative maintenance activities into centralized tracking system. This would enable preventative maintenance activities to be performed concurrently with repair maintenance, resulting in savings in travel time.
- Identify staffing resources to perform preventative maintenance. Preventative maintenance is often underemphasized because maintenance personnel's schedules are filled with "putting out fires." As is true for repair maintenance, a combination of in-house and contractor resources may be required to fulfill this maintenance.
- Order spare parts necessary for preventative maintenance in advance. Some preventative maintenance activities will involve replacement of parts that frequently fail, such as light bulbs. These parts should be kept in stock so that preventative maintenance is not hindered by delays caused by the procurement process. This will require identifying which spare parts are necessary for each device, and the appropriate quantity of each part.

